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ABSTRACT

This paper proposes strategies of motivation in computer based instruction (CBI) derived from motivational foundations of cognitive, affective, and social learning theories. The assumption made here is that motivation and achievement interact in ways that warrant a "holistic" examination of strategies incorporated into CBI. Thus motivation in CBI is not solely a function of affect--it can be strengthened by cognitive and social motivational influences. In this holistic motivational framework, CBI must serve to improve learners' expectations of success, enhance feelings of self-efficacy, increase perception of control, and help learners make positive effort, ability, and strategy attributions. The role of theories and models of motivation and their relevance to CBI are explored, and ways in which computers are amenable to the incorporation of strategies of motivation are explicated. (57 references) (Author)

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Title:

**Motivational Strategies in Computer-Based Instruction:
Some Lessons from Theories and Models of Motivation**

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Abstract

This paper proposes strategies of motivation in CBI derived from motivational foundations of cognitive, affective and social learning theories. The assumption made here is that motivation and achievement interact in ways that warrant a "holistic" examination of strategies incorporated into CBI. Thus motivation in CBI is not solely a function of affect- it can be strengthened by cognitive and social motivational influences. In this holistic motivational framework, CBI must serve to improve learners' expectations of success, enhance feelings of self-efficacy, increase perception of control and help learners make positive effort, ability and strategy attributions. The role of theories and models of motivation and their relevance to CBI is explored, and ways in which computers are amenable to the incorporation of strategies of motivation are explicated.

Motivational strategies in computer-based instruction: Some lessons from theories and models of motivation

Why do children enjoy computers? Why do they choose to return frequently and voluntarily to computer-based tasks? To persist with problem-solving or drills until they have achieved mastery? To demonstrate task engagement while working on the computer? Task persistence, perceived control, level of task engagement, cognitive effort expended, attitude towards learning, cognitive monitoring, expectancies of success, self-efficacy and self-worth have been traditionally studied under a component of learning labelled variously as achievement motivation, continuing intrinsic motivation to learn, intrinsic motivation, need for achievement. In the classroom learning context, extensive theoretical and empirical work has revealed the complex nature of factors affecting intrinsic and extrinsic motivation to learn (Brophy, 1983). This research has contributed towards a variety of interventions with demonstrated empirical merit in improving achievement and motivation.

The intent of this paper is to identify motivational strategies pertinent to a holistic approach to motivation in computer-based instruction. Relevant theories which encompass social, cognitive and affective foundations of motivation to learn are summarized, and implications arising from such theories in strengthening motivational aspects of CBI are explicated. An attempt is made to answer the following questions: What is the relationship between theories of motivation and computer-based motivational strategies? How can the unique attributes of the computer be used to create software incorporating empirically-based findings and guidelines from the theories of motivation? Finally, what functions must motivational aspects of CBI serve?

Computers and Motivation

At a time when there is nationwide concern about declining standardized scores, educators are advocating intelligent

use of technology to make learning efficient, relevant, contemporary and interesting (Clark & Salomon, 1986; Winn, 1989). Motivational factors are an important mediator of performance, and are considered instrumental in the expenditure of cognitive effort (Bandura, 1977; Como and Mandinach, 1983). What students perceive, encode and assimilate in classrooms, in social, affective and academic realms is a function of their motivational states (Thomas, 1980). These conclusions point towards the power of the environment in influencing motivation. Although learning from CBI is not the panacea to the complex issue of academic achievement, it can provide environments which are non-threatening, enjoyable and cognitively stimulating, while boosting achievement.

The unique attributes of computers which make them amenable to motivating instruction are specially apparent when compared to the manner in which classrooms are structured. Classrooms are characterized by a diversity of cognitive and affective aptitudes (Cronbach and Snow, 1977). In the absence of adequate time and attention by a single teacher managing an entire class, students are left on their own to manage the multitude of stimuli generated in the classroom. Learning in classrooms is social and open to evaluation by others (Ames & Ames, 1984). Without appropriate intervention, students may develop stable negative attributions which impinge on performance. Teacher expectations of students also serve as a self-fulfilling prophecies in student performance and behavior, affecting students' self-concept, effort expenditure and hence achievement motivation (Brophy, 1985; Eccles and Midgeley, 1989).

Well-designed computer-based instruction offers an environment which can offset some of these negative influences. By virtue of representing modern technological media, computers have an appeal that evokes curiosity (Brown, 1986). Students approach computers with a positive initial attitude, making them effective attention gaining devices (for eg., Hativa, 1988). In a meta-analysis of 51 CAI studies, Kulik, Bangert and Williams (1983) found that CAI improved attitudes toward coursework and the computer; the authors

surmise that the decreased time in completing CAI assignments may be attributed to motivational influences of the computer. When asked to identify and rate what they liked about CBI and classroom instruction, sixth-grade students rated motivational attributes of computers higher than classrooms (Perez & White, 1985). In the same study, students identified content and computer related (motivational) aspects of CBI, whereas only content related features were identified for classroom instruction. Welsz and Cameron (1989) provide evidence that computers are liked because of the control they offer. Robertson, Ladewig, Strickland and Boschung (1987) found that using supplementary microcomputer instruction yielded significantly higher global self-esteem ratings, leading the authors to conclude that increased achievement which resulted from the use of CAI may have contributed to this increment.

Among the most appealing attributes of computers is their ability to individualize instruction and make it interactive; it is possible to engage learners longer and more meaningfully with individualized interaction (Jonassen, 1984). The cognitive motivational effects of CBI can be observed simultaneously in this adaptive framework: instruction can be so designed that students experience a feeling of success, as reflected in their performance, and develop positive expectancies of success. CBI gives students greater opportunities of choice than a traditional classroom. Immediate, consistent and non-judgemental feedback, an asset in learning from a cognitive viewpoint influences significant determinants of achievement behavior such as self-efficacy and expectancies of success (Hannafin & Dalton, 1984). Because computers are viewed as being fairer than teachers, students with a low self-image in class feel less vulnerable to social comparisons while working with computers. The benefits of immediate feedback in CBI, although seemingly obvious by now, should not be underestimated: it enhances perception of control, and maintains arousal. Finally, it allows students to work at their own pace, reducing the anxiety resulting from speeded learning and tests.

Investigations on computer-based motivational strategies (eg., Malone, 1981) have attempted to isolate variables which contribute to making learning interesting and fun. The focus of this line of research has been an in-depth analysis of computer games to unravel the mystery of sustained interest in learning from computers, resulting in a conceptual framework of motivation in computer-based instruction. However, this research has also culminated in questions regarding the validity of computer-based instructional games in all learning situations (Lepper & Chabay, 1985): should all instructional software be designed in the form of games to make CBI motivationally effective? Is interest or intrinsic motivation observed during games sustained over time? Is performance specific to the fantasy that students learned under? Further, Lepper and Hodell (1989) claim that some instructional games have more negative than positive features, and may provide inordinately high levels of excitement, which are detrimental to learning.

What then, are the determinants of motivation in tasks other than computer-based games? In the ensuing discussion, some such determinants of motivation are hypothesized based on empirical and theoretical support.

The cognitive, affective and social foundations of motivation

Two assumptions form the bases for a holistic approach to motivation in CBI. First, achievement and motivation are fostered through reciprocally interactive processes. Information is attended to, selected, transformed and assimilated with the learners' existing schema, causing shifts in the knowledge structures of the learner; this process, in turn affects values, beliefs, expectations for future tasks, and hence selective perception of incoming stimuli. Such interactions illuminate the significance of the environment- the structure of knowledge existing outside the learner. Salomon (1979) illustrates this elegantly in his theory of "reciprocal interactionism" in values, cognitions, expectations and beliefs between the medium and the learner.

Second, motivation is differentially influenced by cognitive, social and affective

factors among learners with diverse learner characteristics. Several theories of motivation have examined affective sources of motivation; while valuable insight is provided by the role of individual affective variables (eg., persistence, locus of control, attributional style), these do not embody the holistic nature of academic learning, in which affective, cognitive and social forces reinforce each other continually.

Cognitive foundations of motivation: An explicitly cognitive approach to motivation has been the focus several theorists (Como, 1986; Como & Rohmkemper, 1989; Como & Mandinach, 1983; Zimmerman & Pons, 1986). Como & Mandinach (1983) believe that intrinsic motivation is a function of the level of cognitive engagement in a task. It is an outcome of self-regulated learning (SRL), which they define as "an effort put forth by students to deepen and manipulate associative network in content area, and to monitor and improve the deepening process" (p. 95). In this conceptual approach, SRL not only fosters increased learning, but increased motivation as well. The authors consider it the highest form of cognitive engagement, necessary for continued intellectual performance. In Como and Mandinach's model, SRL processes consist of five component processes: alertness, selectivity, connecting, planning and monitoring. Alertness and monitoring are largely information acquisition processes, whereas the remaining three are transformation processes. Both these classes of information processing have a metacognitive component.

Zimmerman & Martinez-Pons (1988) state that self-regulated learners are "metacognitively, motivationally, and behaviorally active participants in their own learning process." (p. 284). They plan, organize, self-instruct, and self-evaluate at various stages during the acquisition process, while selecting, structuring, and even creating social and physical environments.

Como (1986) has also focused on the metacognitive control components of self-regulated learning- cautioning, however, that metacognitive components are necessary but insufficient for self-

regulated learning. From this viewpoint, metacognitive efforts to monitor and control concentration and affect, in conjunction with the application of effective cognitive strategies serve the purpose of efficiency and effectiveness.

Social learning theory and achievement motivation: Social learning theorists such as Bandura (1977; 1982) and Schunk (1984), maintain that the underlying facilitator of cognitive effort expended on learning a skill- the determinant of motivation, is self-efficacy. Self-efficacy is described as personal judgements about one's capability to organize and implement actions in specific situations that may contain novel, unpredictable and possibly stressful features." (Schunk, 1984, p. 48). In this theoretical framework, self-efficacy affects the choice of activity and the mental effort expended in understanding, monitoring and rehearsing. Further, low self-efficacy implies less eager participation in an activity, and vice-versa (Bandura, 1977). Factors affecting self-efficacy appraisal include purpose of instruction, perceived ability, task difficulty, effort, assistance, task outcomes, perceived similarity to models and persuader credibility (Schunk, 1989).

Another perspective on motivation originates from the concept of cooperative learning, extensively researched for its motivational and achievement benefits. For example, Johnson and Johnson (1985) view motivation as resulting from processes of cooperative learning, providing evidence that learners attribute group success to ability, which in turn promotes achievement. In their research cooperative learning has emerged as a strong predictor of academic success when compared to other forms of social interdependence such as competitive and cooperative environments.

From a social learning perspective then, improved achievement results in greater self-efficacy (Schunk, 1989), which is instrumental in expenditure of effort, providing an impetus to achievement.

Affect as a determinant of achievement motivation: Weiner (1979; 1989), proposes that individuals seek causes, or attributions of past success or failure, which in turn dictates their future expectancies of success and achievement behavior. These

causal attributions fall into four categories: ability, task difficulty, effort and luck, and lie along three causal dimensions: internal-external, causal stability, (eg., stable-unstable), and controllability (controllable vs. uncontrollable events). Attributions and causal dimensions interact in different ways; for example, aptitude, effort and health are internal factors (within the volitional control of learner), whereas luck, task difficulty, help from others fall within the external dimension. Failure ascribed to internal factors (eg., lack of ability) produces lower expectancies of success. Similarly, ability is considered a stable dimension (versus effort), and prior outcomes ascribed to ability are more predictive of future performance than ascriptions to effort. Finally, whereas effort is under volitional control, ability is an uncontrollable dimension.

Another variable which has been universally acknowledged to affect motivation is perception of control (Schunk, 1984; Stipek & Weisz, 1981; Thomas 1980). Weisz and Cameron (1985) define it as the ability to cause an intended event. McCombs (1984) states that even if ability to succeed is present, achievement and motivation will be impaired without a perception of control. Perceived control increases judgements of self-efficacy or personal competence, implying positive effect on motivation and achievement.

The role of the self-system in intrinsic motivation: Recently, motivation has been construed as a function of cognitive and affective components, representing a holistic approach to learning. McCombs (1982; 1984), has emphasized the role of perceived self-efficacy and personal control in her proposed definition and perception of "continuing motivation to learn", which is defined as a "dynamic, internally mediated set of metacognitive, cognitive and affective processes (including expectations, attributions, beliefs about the self and the learning environment) that can influence a student's tendency to approach, engage in and expend effort in, and persist in learning tasks on a continuing, self-directed basis" (p. 200). A metacognitive self-awareness is an integral component of this model. McCombs recommends several interventions aimed at

the self to optimize self-regulated learning. These consist of support to students which can focus on both internal self-system processes (eg., helping students change dysfunctional self-beliefs, values or motives via cognitive restructuring approaches), and on modifications to the external learning environments (eg., helping students acquire strategies for self-awareness, self-evaluation and self-monitoring).

Implications: Motivational Strategies for CBI

Implications for strategies promoting achievement through CBI include those derived from cognitive, affective and social learning theories. Cognitive support can be provided to the learner by embedded learning strategies (Jonassen, 1988). Affective support is provided in through strategically designed effort, strategy and ability attributional feedback and by giving learners a perception of control. From a social learning perspective, feedback can be geared towards helping achieve self-efficacious behavior; cooperative learning, peer modeling and proximal goal-setting are suggested for boosting motivation through the enhancement of self-efficacy.

Cognitive approach to motivation in CBI

CBI can enable the development of self-regulated behaviors by providing adequate cognitive support through the incorporation of learning strategies into software design. Weinstein and Mayer (1986) define learning strategies as "behaviors and thoughts that a learner engages in during learning, and that are intended to influence the learner's encoding process" (p. 315). Jonassen (1988) states that currently, the capabilities of microcomputers are underutilized, resulting in shallow processing of content. He recommends a stronger cognitively-oriented approach, making learning more meaningful, generative and engaging during CBI. According to Jonassen (1988), generative learning strategies, that is, those that require learners to consciously relate new, incoming information to existing schema, can be effectively embedded in CBI lessons. Examples of such strategies are outlining, creating images, cognitive

mapping, paraphrasing, summarizing. Thus criterial tasks (eg., practice items) which require students to use these learning strategies actively must be incorporated. CBI can be instrumental in furthering achievement in this respect by replacing rote recall with deeper levels of processing, by forcing students to demonstrate strategic behavior before they can advance further in the lesson, and facilitating students' tasks by performing mechanical functions for them.

With their unique attributes, computers also allow facilitation of cognition through a modeling of cognitive functions (Clark & Salomon, 1986). For example, processing cues- eg., highlighting can help learners who cannot use these effectively (Jonassen & Hanuum, 1987). Gillingham (1988) proposes that in addition to presenting text in meaningful ways, CBI can monitor the reading of text in various ways to increase reader comprehension.

The role of another important determinant of achievement and motivation- "metacognition" is being increasingly recognized (eg., Armbruster, 1983; Baker & Brown, 1983; Flavell, 1979). Metacognition is described as the "knowledge and control the child has over his or her own thinking and learning activities." (Baker & Brown, 1983. p. 353). Use of cognitive and metacognitive strategies can strengthen the effectiveness of primary strategy use, promote performance and perception of control. Jonassen refers to these as "support strategies", or higher level executive control, and suggests that self-monitoring advisement or prompting on activities like planning, attending, encoding, reviewing, evaluating can be efficaciously incorporated in CBI.

Motivational CBI and the social learning perspective

Social learning theories such as Bandura (1977) and Schunk (1982; 1984) have empirically demonstrated the benefits of interventions designed to improve self-efficacy and hence performance among low-achievers. Among those which are relevant to CBI are effort attributional feedback related to past accomplishments, ability feedback, proximal goal-setting and peer modeling.

Research on cooperative learning approaches with CBI is beginning to identify variables critical for improved performance (Johnson, Johnson & Stanne, 1985; Hooper & Hannafin, 1988; Hooper, Ward, Hannafin and Clark, 1989; Webb, 1984) and fomenting positive attitudes (Dalton & Hannafin, 1984). Johnson & Johnson (1985) found that a combination of cooperative learning and computer-assisted instruction has an especially positive impact on female students' attitude towards computers. The role of the peer group as one of the most important external sources of support in computer-based instruction is emphasized by Brown (1986). In light of these findings, CBI should be designed to be adaptable for use with groups. Teachers must also explore benefits of peer modeling approaches (Bandura, 1982) to improve self-efficacy via cooperative learning. Software design should be flexible so that it includes goal structures (Johnson & Johnson, 1985), indices for group and individual success and accountability. Prompts on proximal goal-setting, and ability attributional feedback based on past successes can be powerful mediators in improving self-efficacy, leading to increased persistence in task performance (Schunk, 1989). The importance of performance feedback cannot be overemphasized: If it is frequent, contingent, informative and encouraging, it has primary impact on performance attributions and self-efficacy (Como & Rohrkemper, 1984).

Motivational strategies from the affective domain

Learner Control

Researchers of CBI believe that giving some kind of control to learners- the nature of which is still elusive- is desirable: It increases learners' feelings of perceived control and self-efficacy (Bandura, 1982; Stipek and Weisz, 1981), makes learning more relevant to the needs of learners, and improves attitudes (Weisz & Cameron, 1989). Lepper & Hodeil (1989) claim that a lack of control can lead to learned helplessness. According to Merrill (1987), learners themselves arrive at self-determined instructional strategies which are optimum, when given an opportunity to

exercise choice over them. In light of such benefits, it is unfortunate that students' autonomy and choice decline as they advance in grade level (Ecles & Midgeley, 1989). CBI can be instrumental in compensating for the structural inflexibility of school systems.

Which learners benefit from learner control in improving motivation is determined by relationships among ability, prior knowledge, task difficulty and nature of control (Snow, 1980; Steinberg, 1977). Interactions among these variables are the subject of current research on learner control. However, given their intrinsic flexibility, computers offer instructional designers a myriad of possibilities in presenting instructional content. Incorporation of strategies that allow learners to choose amount, sequence, pace, difficulty level of content can be achieved relatively easily. However, all strategies should be considered with attention to empirical findings to date (eg., Hannafin, 1984).

The "Bells and Whistles" of CBI

The instantaneous image conjured of motivation in the realm of computer-based instruction - complex, arresting animation, sounds, colorful graphics and text, although simplistic in nature, has piqued the curiosity of researchers who have studied these media attributes individually or collectively.

The embellishments that computers offer can be highly effective in promoting extrinsic motivation. Surber and Leeder (1988) required fourth and fifth graders to complete two versions of a lesson, one with graphic feedback, and the other with text feedback. Students in the graphic feedback condition returned to the drill more often than those in the text feedback condition. The advanced visual capabilities of computers- graphics and animation, permit the creation of effective, credible fantasies, an important variable identified in the design of computer games (Malone, 1981). Competition and challenge can be provided with a score and time counter, and by adaptively varying task difficulty (Jonassen and Hanuum, 1987). Recently, studies which compare the motivational and achievement influences exerted by an embellished versus a simple, non-

embellished version of a lesson are beginning to show that the former not only attract children more often, but students also demonstrate increases in achievement scores over time (Lepper and Hodel, 1989). Thus the cumulative effects of entities such as color, graphics, and animation can be instructionally and motivationally powerful.

Effort, Ability and Strategy attributional feedback

The objective of attributional feedback is to facilitate learners' own perception of themselves as able, efficacious learners. It should help them see that effort and effective strategy use improve performance (Brophy, 1983), and hence foment a change in negative orientations towards themselves (McCombs, 1984). Research has demonstrated the benefits of effort attributional training in shifting learners' dysfunctional beliefs about their own ability (uncontrollable factor), towards attributions to effort and strategy use (Dweck, 1975). Clifford (1984) believes that strategy attributional feedback on failures can change them into problem-solving situations, diverting attention from the negative aspects of failure. Studies employing strategy training have yielded successful results: In one such study by Kurtz and Borkowski (1984), students who attributed success to effort were more strategic than those attributing outcomes to ability. Although no prescriptive rules exist for the design of effort versus ability attributional feedback, relationships between aptitudes, attributional style, age and sex are significant in determining the situation specific requirements of such feedback.

Researchers' efforts at changing students' negative perceptions about their own ability have focused on shifting such beliefs towards effort and strategy attributions, with the assumption that student behavior and attitudes are malleable (Brophy, 1985). Although such research has yielded positive results, perceptions about one's ability (an uncontrollable, stable causal dimension) exert a more powerful influence in predicting performance, affect and behavior than effort, a controllable factor (Nicholls, 1979; Weiner, 1984). Thus both ability and

effort warrant consideration in the design of feedback. Students like to perceive themselves as both able and hardworking (Covington & Omelich, 1979). Brophy (1983) states this succinctly: "Students must be able to conclude that they have the ability to meet the demands made on them, if they make reasonable efforts to do so." (p. 202). To accomplish such perceptions the difficulty level of tasks should be easy to medium, with varying ability and effort attributions, depending on student ability, nature of task, demonstrated persistence.

Individual differences such as age appear to have a bearing on the conceptions of ability. Nicholls (1984) has demonstrated that different conceptions of ability should be used for different situations. For example, for adolescents the concept of ability is norm-referenced, whereas for young children it is self-referenced. Young children associate effort with ability, whereas adolescents attribute high ability to a difficult task which requires less effort. Thus excessive effort attributional feedback may be counterproductive to adolescents' conception of ability, and beneficial for young children's beliefs.

Conclusion

Academic learning is intrinsically difficult, requiring concentration, self-regulated behaviors, persistence, cognitive effort and a positive, mastery-oriented outlook. In this context, the role of motivational influences in improving affect and achievement becomes even more critical. The motivational role of computers transcends beyond providing short-term interest and excitement for supplementary classroom tasks. As classroom and home use of computers increases, an innovative, creative role must be delegated to CBI in the development and maintenance of intrinsic motivation. From a cognitive viewpoint, CBI must provide meaningful, cognitively supportive instruction, geared towards improved performance; from an affective perspective, CBI should captivate the learner's attention, promote feelings and expectations of success, improve perception of control, increase positive attributions to effort and ability; and finally, from a social learning perspective, CBI must enhance self-efficacy and foster

achievement and positive affect through social interactions, proximal goal-setting and attributional feedback. The concept of motivation in this framework is construed as that in which students show moderate levels of arousal; demonstrate metacognitive awareness and persistence using varying learning strategies (computer-provided or self-generated); make appropriate attributions to ability and effort; demonstrate perception of control, and learn through social interactions.

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